

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE HONORABLE BOARD OF PATENT APPEALS AND INTERFERENCES

re the Application of

Hideyuki KURITA et al.

Group Art Unit: 2825

Application No.: 09/688,181

Examiner: G. Lee

Filed: October 16, 2000

Docket No.: 107594

For: MULTILAYER FLEXIBLE WIRING BOARDS AND PROCESSES FOR  
MANUFACTURING MULTILAYER FLEXIBLE WIRING BOARDS

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BRIEF ON APPEAL

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Appeal from Group 2825

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TABLE OF CONTENTS

	<u>Page</u>
I. Real Party in Interest .....	1
II. Related Appeals and Interferences .....	1
III. Status of Claims.....	1
IV. Status of Amendments .....	1
V. Summary of Invention.....	1
A. Problems Addressed by the Invention.....	1
B. Description of the Claimed Invention.....	2
VI. Issues .....	3
A. Whether the Office Action's rejection of claims 2-4, 6, 10-13, 20 and 22 under 35 U.S.C. §103(a) over JP 1-202898 in view of JP 5-327212 is in error.....	3
B. Whether the Office Action's rejection of claims 17-19 and 21 under 35 U.S.C. §103(a) over JP 1-202898 in view of JP 5-327212 and further in view of WO 94/29897 is in error. ....	3
VII. Grouping of Claims.....	3
VIII. Argument .....	4
A. Summary of the Relevant Law.....	4
B. The 35 U.S.C. §103(a) Rejections of Claims 2-4, 6, 10-13, 20 and 22 Lack Factual Support .....	5
1. Claim 2 .....	5
2. Claims 10-13 and 20 .....	7
3. Claims 17-19 and 21 .....	8
IX. Conclusion.....	9
APPENDIX A.....	A-1

**I. Real Party in Interest**

The Assignee of this application, Sony Chemicals Corporation (by the Assignment

Recorded beginning at Reel 011251, Frame 0524), is the real party in interest.

**II. Related Appeals and Interferences**

There are no related appeals or interferences.

**III. Status of Claims**

Claims 2-4, 6, 10-13 and 17-22 are pending. The attached Appendix includes a copy of each pending claim. Claims 1, 5, 7-9 and 14-16 were previously cancelled. The Examiner's rejection of claims 2-4, 6, 10-13 and 17-22 set forth in the April 8, 2003 Office Action, is appealed.

**IV. Status of Amendments**

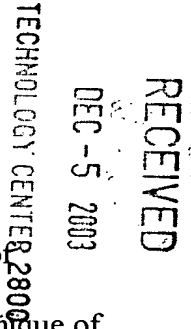
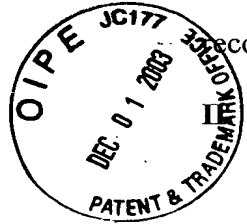
No amendments have been filed after the April 8, 2003 Final Rejection. However, an Information Disclosure Statement citing recently uncovered references was filed on August 22, 2003.

**V. Summary of Invention**

**A. Problems Addressed by the Invention**

The invention relates to flexible wiring boards and methods and techniques of manufacturing flexible wiring boards. In particular, the invention relates to the technique of laminating flexible wiring board pieces into a multilayer flexible wiring board structure.

As described at page 2, beginning at line 13, when laminating one flexible wiring board piece 110 to another flexible wiring board piece 130, the first flexible wiring board piece 130 is mounted on a table with openings 139 facing upward and opposed to the other flexible wiring board piece 110 bumps 121 facing downward. See Figs. 10A and 10B. Then, the top of bump 121 is contacted with the surface of the metal wiring 135 at the bottom of the opening 139, and an ultrasonic resonator is pressed against the base film 117 of one of the



flexible wiring board pieces 110. The ultrasonic resonator 145 is pressed against the flexible wiring board pieces 110 and 130 so that the ultrasonic resonator 145 applies an ultrasonic wave to these wiring board pieces. Thus, bumps 121 are connected to the metal of wiring 135 in contact with these bumps by the ultrasonic vibration. Then, these flexible wiring board pieces 110 and 130 are heated under pressure so that the resin film 112 softens to develop adhesiveness. Thus, the use of the ultrasonic resonator 145 eliminates the use of solder to electrically connect flexible wiring board pieces 110 and 130. However, this method requires that the bumps 121 are formed by a complex copper plating process. When the ultrasonic resonator is pressed against the flexible wiring board pieces to apply an ultrasonic wave, connection failure may occur if the heights of bumps 121 are not uniform. For example, the reference 151 in Fig. 10C represents such a connection failure in which a lower bump 122 is not connected to the metal wiring 135 during ultrasonic application in contrast with a higher bump 121 connected to the surface of metal wiring 115. The bumps 121 should have a uniformity of height within  $\pm 3$  mm or less to efficiently connect flexible wiring board pieces. However, this uniformity is difficult to achieve when the bumps are formed by electroplating as described above. Moreover, bumps 121 should fill openings 120 and project from the surface of the resin film 112 by growing copper to a thickness of 40  $\mu$ m or more. However, it takes in excess of one hour to attain such a thickness by electroplating, resulting in increased production costs and reduced efficiency or reduced production speed.

**B. Description of the Claimed Invention**

Referring, for example, to Figs. 5A-5D, one flexible wiring board piece 30 of the two flexible wiring board pieces 10, 30 is mounted on a table or surface 35 so that the opening 34 in the resin film 33 of the flexible wiring board piece faces upward opposite to the contact region 18<sub>1</sub> of the metal wiring body 18 provided on the base film 12 of the flexible wiring board piece 10.

The two flexible wiring board pieces 10 and 30 are superimposed, i.e., placed in close contact with each other at their surfaces, so that the contact region 18<sub>1</sub> of wiring board 10 having a contact region 18<sub>1</sub> is placed in the concave opening 34 of the wiring board piece 30.

As shown in Fig. 5C, an ultrasonic resonator 45 is provided above contact regions 18<sub>1</sub> in contact with the opposite side of contact region 18<sub>1</sub> of the wiring board piece 10 so that the metal wirings 18<sub>1</sub> of the wiring board pieces 10 and 30 are bonded together resulting in the two electrically connected flexible wiring board pieces 10, 30 illustrated in Fig. 5D.

## **VI. Issues**

- A. Whether the Office Action's rejection of claims 2-4, 6, 10-13, 20 and 22 under 35 U.S.C. §103(a) over JP 1-202898 in view of JP 5-327212 is in error.**
- B. Whether the Office Action's rejection of claims 17-19 and 21 under 35 U.S.C. §103(a) over JP 1-202898 in view of JP 5-327212 and further in view of WO 94/29897 is in error.**

## **VII. Grouping of Claims**

Each claim of the patent application is separately patentable, and upon issuance of a patent, will be entitled to a separate presumption of validity under 35 U.S.C. §282. For convenience and handling of this appeal, the claims are grouped as follows:

- Group I: Claims 2, 3, 4, 6 and 22;
- Group II: Claims 10-13 and 20;
- Group III: Claims 17-19 and 21.

The groups do not fall together. However, because claim 17 includes all the features of claim 2, and because claims 18, 19 and 21 include all the features of claim 10, the claims of Group III are patentable for all the reasons set forth for their respective claims of Groups I and II.

## VIII. Argument

### A. Summary of the Relevant Law

In rejecting claims under 35 U.S.C. §103, it is incumbent on the examiner to establish a factual basis to support the legal conclusion of obviousness. In re Fine, 837 F.2d 1071, 1073, 5 USPQ2d 1596, 1598 (Fed. Cir. 1988). In so doing, the examiner is expected to make the factual determinations set forth in Graham v. John Deere Co., 383 U.S. 1, 17-18, 148 USPQ2d 459, 467 (1966), and to provide a reason why one of ordinary skill in the pertinent art would have been led to modify the prior art or to combine prior art references to arrive at the claimed invention. Such reason must stem from some teaching, suggestion or implication in the prior art as a whole or knowledge generally available to one having ordinary skill in the art. Uniroyal, Inc. v. F-Wiley Corp., 837 F.2d 1044, 1051, 5 USPQ2d 1434, 1438 (Fed. Cir. 1988) cert. denied, 488 U.S. 825 (1988); Ashland Oil, Inc. v. Delta Resins & Refractories, Inc., 776 F.2d 281, 293, 227 USPQ 657, 664 (Fed. Cir. 1985), cert. denied, 475 U.S. 1017 (1986); ACS Hospital Systems, Inc. v. Montefiore Hospital, 732 F.2d 1572, 1577, 221 USPQ 929, 933 (Fed. Cir. 1984). These showings by the examiner are an essential part of complying with the burden of presenting a prima facie case of obviousness. In re Oetiker, 977 F.2d 1443, 1445, 24 USPQ2d 1443, 1444 (Fed. Cir. 1992).

The mere fact that the prior art may be modified in the manner suggested by the examiner does not make the modification obvious unless the prior art suggested the desirability of the modification. In re Fritch, 972 F.2d 1260, 1266, 23 USPQ2d 1780, 1783-84 (Fed. Cir. 1992). To establish prima facie obviousness of a claimed invention, all the claim limitations must be suggested or taught by the prior art. In re Royka, 490 F.2d 981, 180 USPQ 580 (CCPA 1970). All words in a claim must be considered in judging the patentability of that claim against the prior art. In re Wilson, 424 F.2d 1382, 1385, 165 USPQ 494, 496 (CCPA 1970).

If the PTO fails to meet this burden, then the applicant is entitled to a patent. In re Glaug, 62 USPQ2d 1151 (Fed. Cir. 2002). In the present case, and as will be detailed below Appellants respectfully submit that the Examiner has failed to meet this burden, and that the Office Action violates the substantive and procedural due process which the Office is supposed to accord Applicants via the Administrative Procedures Act. See in this regard, Dickinson v. Zurko, 527 U.S. 150, 50 USPQ2d 1930 (1999), and In re Gartside, 203 F.3d 1305, 1316, 53 USPQ2d 1769, 1776 (Fed. Cir. 2000).

**B. The 35 U.S.C. §103(a) Rejections of Claims 2-4, 6, 10-13, 20 and 22 Lack Factual Support**

**1. Claims 2-4, 6 and 22**

Claims 2-4, 6 and 22 stand rejected under 35 U.S.C. §103(a) over JP 1-202898 in view of JP 5-327212. This rejection is respectfully traversed.

With respect to independent claim 2, neither of the applied references, in combination or alone, discloses or suggests a process for manufacturing a multilayer flexible wiring board comprising at least the steps of placing the metal wirings of two flexible wiring board pieces in close contact with each other at their surfaces and contacting the tip of an ultrasonic resonator with the exposed opposite side of a bonding portion of the metal wirings of at least one flexible wiring piece of the two flexible wiring board pieces to be bonded, and applying an ultrasonic wave to the ultrasonic resonator to bond the two metal wirings, as recited in claim 2.

By placing the metal wirings of the two flexible wiring board pieces in close contact with each other and contacting the exposed opposite side of the bonding portion with the ultrasonic resonator while the metal wirings are in contact with each other at their surfaces, the formation of bumps via electroplating is eliminated, thus reducing failure of the electrical connection due to non-uniformity of the bump height.

JP 1-202898 discloses a process for manufacturing multilayer flexible wiring boards including the steps of laminating a substrate designated as a y-axis pattern layer 10 and a substrate designated as a x-axis pattern layer 20 by connecting y-axis conductive material pattern 15 of the y-axis pattern layer with the x-axis pattern layer 25 by thermo-compression bonding. Insulating films 16 and 17 provided on an opposite surface of the y-axis pattern layer 10 and insulating films 26 and 27 provided on an opposite surface of the x-axis layer 25 are removed by pressing the position of the window 22 at the through-hole 2 with thermo-compression bonding electrode 30. The x-axis pattern layer and the y-axis pattern layer are not placed closely together and then bonded by applying ultrasonic waves. Furthermore, if, as alleged by the Office Action, the ultrasonic wave apparatus of JP 5-327212 is used in conjunction with the process of JP 1-202898, instead of the thermo-compression electrode 30, it would be impossible to electrically connect the y-axis pattern layer to the x-axis pattern layer because the ultrasonic wave is not capable of melting the insulating layers to be removed. Thus, the modifications of the references proposed in the Office Action would be inoperable.

Moreover, the combination of applied references would not have resulted in the claim 2 invention because JP 5-327212 teaches a conductive part connected by solder bonding 3 so that the solder 3, such as tin foil, is interposed between the printed wiring boards 1a and 1b. Contrast this with the claim 2 method, in which the metal wirings are connected in close contact with each other by application of an ultrasonic wave to the metal wirings.

The Office Action alleges that it would have been obvious to a person of ordinary skill in the art to modify the teachings of JP 1-202898 to incorporate those of JP 5-327212 with the likelihood of achieving better individual soldering results since ultrasonic soldering can be made to any joint, chip or board within the soldering process, with an energy source, and not by applying thermo-compression alone. However, for the reasons set forth above, Applicants

respectfully submit that even if the teachings of JP 5-327212 are combined with JP 1-202898, the combination still fails to teach the features of claim 2.

Accordingly, independent claim 2 and dependent claims 3, 4, 6 and 22 are patentable over the combination of applied references.

**2. Claims 10-13 and 20**

Claims 10-13 and 20 also stand rejected under 35 U.S.C. §103(a) over JP 1-202898 in view of JP 5-327212. This rejection is respectfully traversed.

With respect to independent claims 10 and 12, Applicants respectfully submit that the combination of applied references fails to disclose or suggest a multilayer flexible wiring board that is formed by laminating at least two flexible wiring board pieces having a base film and a metal wiring provided on the base film, wherein at least one flexible wiring board piece has a cover film including a resin film on the metal wiring, and a first opening is provided on the cover film, and the metal wiring exists at the bottom of the first opening so that the metal wirings of the flexible wiring board pieces are electrically bonded to each other by applying an ultrasonic wave while the part of the metal wiring located at the bottom of the first opening is in close contact with the metal wiring of the other flexible wiring board piece, and further wherein the first opening and the metal wiring located at the bottom of the first opening form a concave and the part of the metal wiring of the other flexible wiring board piece to be bonded to the concave forms a convex on the base film, as recited in claim 10 and similarly recited in claim 12.

In contrast to claims 10 and 12, JP 1-202898 teaches multiple circuit boards connected by thermo-compression bonding. In JP 1-202898, as shown in Fig. 2B, the insulating films 27, 26, 17 and 16 are removed through melting by pressing the position of the window 22 at the through-hole 2 with thermo-compression bonding electrode 30. The result of the process taught in JP-a-202898 is that the projection part 2a of the through-hole, the y-axis conductor

pattern 15 and x-axis conductor pattern 25 are electrically connected together. However, as seen in Fig. 2 of JP 1-202898, the projection part 2a of the through-hole is necessary to provide counter-resistance to the thermo-compression bonding electrode 30. The bonding electrode presses down on the x- and y-axis conductor patterns to force the connection against the resistance of the projection part 2a of the through-hole and to melt the layers to be removed. The method of claims 10 and 12 requires no such counter-resistance because the connection portions 19 of the wiring boards 10 and 30 are inversely oriented such that the bottom flexible wiring board piece contains a concave opening in the metal wiring while the other flexible board piece forms a convex portion which mates with the concave opening of the bottom wiring board piece 30. See Figs. 5A-5D.

The Office Action relies upon JP 5-327212 to teach using ultrasonic waves to bond the two boards together through their respective conductive bonding areas. However, JP 5-327212 fails to supply the deficiencies of JP 1-202898 as discussed above.

Accordingly, independent claims 10 and 12 and their respective dependent claims 11, 13 and 20 are patentable over the applied references.

### **3. Claims 17-19 and 21**

Claims 17-19 and 21 stand rejected under 35 U.S.C. §103(a) over JP 1-202898 in view of JP 5-327212 and further in view of WO 94/29897. This rejection is respectfully traversed.

The Office Action relies upon WO 94/29897 for teaching the specific metallurgies of the materials used. However, WO 94/29897 fails to supply the deficiencies as set forth above with respect to either JP 1-202898 or JP 5-327212. Accordingly, claims 17-19 and 21 are also patentable over the combination of applied references.

**IX. Conclusion**

For at least the reasons set forth above, it is respectfully submitted that claims 2-4, 6, 10-13 and 17-22 are patentable over the applied references. Applicants respectfully request this Honorable Board to reverse the rejection of these claims.

Respectfully submitted,



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Enclosure:

Claim Appendix

Date: December 1, 2003

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## APPENDIX A

### CLAIMS:

Claims 2-4, 6 10-13 and 17-22 are the only claims pending

2. A process for manufacturing a multilayer flexible wiring board by bonding metal wirings of at least two flexible wiring board pieces having a base film including a resin film and a metal wiring provided on said base film, comprising the steps of:

a) placing said metal wirings of said two flexible wiring board pieces in close contact with each other at their surfaces,

b) contacting the tip of an ultrasonic resonator with an exposed opposite side of a bonding portion of said metal wirings of at least one flexible wiring board piece of two flexible wiring board pieces to be bonded; and

c) applying an ultrasonic wave to said ultrasonic resonator to bond said two metal wirings to be bonded.

3. The process according to claim 2, further comprising the steps of:

providing a thermoplastic resin layer on said at least one flexible wiring board piece to be exposed to the bonding portion of said metal wiring before performing step a), and

adhering said two flexible wiring board pieces using said thermoplastic resin layer after performing step c),

wherein said two metal wirings are electrically bonded by the step c).

4. The process according to claim 3, wherein said metal wirings are ultrasonically bonded and then heated to laminate said flexible wiring board pieces by the adhesion of said thermoplastic resin.

6. The process according to claim 2, wherein ultrasonic wave is individually applied to the parts of said metal wirings to be bonded.

10. A multilayer flexible wiring board that is formed by laminating at least two flexible wiring board pieces having a base film and a metal wiring provided on said base film, wherein at least one flexible wiring board piece has a cover film including a resin film on said metal wiring and a first opening is provided on said cover film, and said metal wiring exists at the bottom of said first opening so that said metal wirings of said flexible wiring board pieces are electrically bonded to each other by applying ultrasonic wave while the part of said metal wiring located at the bottom of said first opening is in close contact with said metal wiring of the other flexible wiring board piece, and further wherein said first opening and said metal wiring located at the bottom of said first opening form a concave, and the part of said metal wiring of the other flexible wiring board piece to be bonded to said concave forms a convex on said base film.

11. The multilayer flexible wiring board according to claim 10 wherein said convex part of said metal wiring of the other flexible wiring board piece has an area smaller than the area of said first opening forming said concave.

12. A multilayer flexible wiring board formed by laminating at least two flexible wiring board pieces having a base film and a metal wiring provided on said base film, wherein said base film of at least one flexible wiring board piece has a second opening in which said metal wiring exists at the bottom so that said metal wirings are electrically bonded to each other by applying ultrasonic wave while said metal wiring of the other flexible wiring board piece is in close contact with said metal wiring located at the bottom of said second opening, said second opening and said metal wiring located at the bottom of the second opening form a concave, and the part of the metal wiring of the other wiring board piece to be bonded to said concave forms a convex.

13. The multilayer flexible wiring board according to claim 12 wherein said base film has insulating properties to prevent said connected metal wirings from contacting with each other except for the part located at said second opening.

17. The process according to claim 2, wherein a metal coating is preliminarily formed on at least one of the surfaces of the parts of said metal wirings to be ultrasonically bonded before said metal wirings are ultrasonically bonded, the metal coating including at least one of gold, silver, nickel, copper-nickel alloy, aluminum, titanium and solder.

18. The multilayer flexible wiring board according to claim 10, wherein at least one of the surfaces of the parts of said metal wirings to be ultrasonically bonded has a metal coating, the metal coating including at least one of gold, silver, nickel, copper-nickel alloy, aluminum, titanium and solder.

19. The multilayer flexible wiring board according to claim 18, wherein said metal wirings to be bonded to each other have the same type metal coating on their surfaces.

20. The multilayer flexible wiring board according to claim 10, wherein said cover film has insulating properties to prevent said connected metal wirings from contacting with each other except for the part located at said first opening.

21. The multilayer flexible wiring board according to claim 20, wherein said cover film has a thermoplastic resin layer developing adhesiveness upon heating at least on its surface.

22. A process for manufacturing a multilayer flexible wiring board according to claim 2 further comprising the steps of:

projecting said bonding portion of one flexible wiring board piece in said two flexible wiring board pieces at the top of a convex and exposing said bonding portion of the other flexible wiring board piece at the bottom of a concave before performing step a), and

with said bonding portions being in close contact with each other, putting said bonding portion of the convex into said bonding portion of the concave at step b).